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NEW SOVIET HARBOR ICEBREAKER

- USSR -

by A.N. Vasilevskiy

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NEW SOVIET HARBOR ICEBREAKER

[Following is a translation of an article by Engineer A. N. Vasilevskiy in Sudostroyeniye (Shipbuilding), No. 1, Leningrad, January 1960, pages 6-8.]

The Admiraltskiy Shipyard has started to build a 5,400 H.P. icebreaker intended for the escort of ships under ice conditions in port waters, for breaking up ice flows, towing at close range or on a long towline and for mooring ships inside ports.

The attempt to design an icebreaker-tug endowed with good maneuvering properties is reflected in the selection of the main ship dimensions, engine unit, installations and equipment (Table 1).

In view of the limited draft a maximum reduction of the ships weight factors was necessary. In particular, the weight factor was taken into account during the selection of the steel grade for the hull of the icebreaker.

Hull construction. All hull connections were designed on the basis of the requirements listed in the Rules of the USSR Register, applicable to class ULR $\frac{1}{4}$S (icebreaker) category I ships.

The main hull has a transverse frame system; intermediate frames of the same profile as the basic frames are installed along the entire length of the hull.

Frame spacing between frames 13 and 87 is equal to 600 mm. and is equal to 680 mm. from frame 13 to the bow and from frame 87 to the stern. At both extremities of the ship, the main and intermediate frames are perpendicular to the board.

The ice belt has a thickness of 16 mm. at the midsection and stern extremity, and 18 mm. in the bow section. The belt is made of alloyed steel. The board framing is made of the same type of steel. The figures listed in Table 2, correspond to the ice pressure which the board can withstand.

TABLE 1

BASIC ELEMENTS AND CHARACTERISTICS OF ICEBREAKERS

Elements and Characteristics	Type of Icebreaker			
	Harbor	"Ilya Muromets"	"Thule"	"El'bion"
Maximum length, L_{max},(m.)	67.67	56.9	52.3	51.0
Waterline length, L_{wtl}, (m.)	62.0	53.0	57.0	48.0
Maximum beam, B_{max}, (m.)	18.06	15.0	16.07	12.0
Waterline beam, B_{wtl}, (m.)	17.5	14.3	15.20	--
Normal draft T, (m.)	5.5	6.05	4.85	4.8[illegible]
Freeboard H, (m.)	8.3	8.60	8.25	--
Normal displacement D, (t.)	2718*	--	1970	1400
	Diesel-Electric	Steam engine	Diesel-electric	Diesel electric
Type of propulsion (engine unit)	5400	3700	4800	360[illegible]
Power of engine unit, (H. P.)	3.54	3.70	3.75	--
Ratio of length to beam at waterline $\frac{L_{wtl}}{B_{wtl}}$	20	18	20	--
Camber of sides at midship, (deg.)	25	25.5	23.0	--
Inclination of stem near the waterline, (deg.)	25	29.0	26.0	--
Tapering angle of waterline at the bow (On one side), (deg.)	0.446	0.41	0.46	--
Effective displacement factor? Effective waterline factor?	0.688	--	--	--

*With a 12-day supply of fuel, water, oil.

TABLE 1 Continued from page 2

Type of icebreaker						
"Sture-b'yern"	"Malygin"	"Severnyy Veter" [North Wind]	"Voyma"	"Imer"	"Kapitan Beloussov"	"Karkh[illegible]
60.0	64.18	82.0	83.5	--	--	74.[illegible]
55.1	61.21	76.56	77.5	75	80	68.[illegible]
15.0	14.2	19.35	19.4	--	--	16.[illegible]
14.29	13.99	18.91	18.70	18.6	19.2	16.[illegible]
5.55	5.11	7.85	6.20	6.4	7.0	5.[illegible]
7.30	5.72	11.50	9.50	9.6	9.5	8.[illegible]
2500	2070	5425	4415	2300	5360	337[illegible]
Steam engine	Steam engine	Diesel-electric	Diesel-electric	Diesel-electric	Diesel-electric	Diesel-electric
5400	3700	10,000	9750	9000	9750	7500
3.86	4.37	4.05	4.14	4.03	4.2	4.[illegible]
11	15	20	20	18	20	--
24.0	23.0	30.0	23.0	25	23	--
--	--	31.0	25.0	29.0	--	--
0.533	0.476	0.47	0.485	0.48	0.49	0.[illegible]
0.734	--	--	0.701	--	--	--

TABLE 2

ICE LOADS WHICH THE BOARD CAN WITHSTAND

Type of Load ($T./m^2$)	Middle Section	Extremities	
		Stern	Bow
Load withstood by shell plating	150	190	270
Concentrated load withstood by frames	80	95	160
Equally distributed load over a length of 1 m., withstood by frames	100	125	200

The hull connections not subject to ice pressures are designed in accordance with the requirements of the Register, and are made of steel grades 09G2 or St. 4c.

The hull of the icebreaker "Ilya Muromets" served as a basis for the theoretical blueprints of the ship. In order to reduce the ice resistance, the vessel lines were designed without any flat sections.

The icebreaker has three screw propellors: one bow and two stern propellers.

The vessel is divided into eight main watertight compartments. In addition, longitudinal /or fore-and-aft/ watertight bulkheads, forming a "second board", are installed in the machine rooms. In order to reduce the volume of noise in living and service quarters, all main Diesel generators are located in a separate compartment, and the auxiliary Diesel generator compartment. The change in the number of revolutions of the main Diesels will be accomplished from a central control post; as a result, it will be possible to locate the watch in the relatively "quiet" auxiliary Diesel generator room, and to reduce the crew to 6 men, since a full-time watch is not required in the main Diesel generator compartment. On the lower deck between the Diesel generator compartments the central control station is located which contains the main switchboard, and the electric propulsion board and control panel.

The ship's crew (26 men) is housed in double cabins on the upper deck, while the officer staff (13 men) are housed in single cabins on the raised prow and first bridge decks. The captain's and first mate's cabins consist of a study, a bedroom and a lavatory.

The wardroom and the senior officer quarters are decorated with a hardwood veneer (beech or oak), while the quarters occupied by the rest of the officers are finished in decorative DOF veneer (plywood) or laminated plastic.

Instead of "Expanzite", staple fiberglass is widely used as a heat-insulating material in various quarters of the icebreaker.

The furniture has been selected from models manufactured for the atomic icebreaker "Lenin".

The radio room, wheelhouse and charthouse are located on the second bridge deck. The wheelhouse extends from one side of the ship to the other.

The cruising speed in open water is 13.5-14 knots. The fuel supply makes it possible to operate the main and auxiliary Diesel generators for 17 days at full power. The cruising range at 13.5 knots is 5600 miles. By using two Diesel generators acting upon two stern propellers, the speed will amount to about 13 knots, and the cruising range will be increased to 7,800 miles.

The vessel will not sink as a result of the flooding of any one compartment. The icebreaker will stay afloat, having a positive freeboard and emergency stability, after the flooding of the two extreme bow or stern compartments.

The power plant (engine unit) is a three-shaft, Diesel-electric, direct current unit. Electric propulsion engines are supplied with power from three main Diesel generators.

The main Diesel generators, type 13D100, consist of a D100 Diesel generator and double armature (rotor) generators of the PN-145 type, with a power of 2 x 625 kwt and a voltage of 400 v.

The power supply circuit makes it possible to operate under the following conditions:

a) Operation of one of the two Diesel generators acting upon the bow electric propulsion motor;

b) Operation of any two Diesel generators acting upon the two stern electric propulsion motors;

c) Operation of three Diesel generators acting upon two stern electric propulsion motors;

d) Operation of any Diesel generator acting upon two stern electric propulsion motors.

The vessel is also equipped with three DGT 200/1 auxiliary ac Diesel generators, having a total power of 600 kwt with 6ch 25/34 motors. On station (while standing in port), the ship will receive its power from a service Diesel generator of 100 kwt. capacity.

To reduce noise during operation of the main Diesel generators, air intake will not take place inside the quarters, but from the outside, and in addition, the ceiling of the compartment is lined with a sound-absorbing insulating layer of Capron synthetic fiber.

Ship Systems. The heeling system provides for an automatic pumping of ballast from one side of the ship to the other in approximately 2 minutes, whereby the heeling angle will be not less than 5°.

The trim system makes it possible to vary the bow or stern draft by at least 1 m. in 12 minutes. Control of both systems is centralized.

In order to provide fire-fighting assistance to other ships or shore installations, the ship is equipped with 3 carriage-mounted nozzles located on the navigation deck.

Other systems were designed in accordance with the Register Rules.

Installations and Equipment. For towing ships, the vessel is equipped with a two-drum automatic electric winch, having a tractive force of 25 tons on the main drum, and 10 tons on the auxilliary drum.

Mooring operations are performed at the stern with the help of small gabions of the towing winch, and at the bow by means of anchoring-mooring capstans. For loading food supplies onto the deck of the vessel, as well as for loading freight weighing up to 3 tons into the cargo holds, the ship is equipped with 2 winches and 2 cargo booms.

The icebreaker carries two light-weight alloy motor lifeboats, seating 28 men. Two 4-oared boats, are available for working operations.

The building of icebreakers with a limited draft and good maneuvering properties will make it possible to significantly improve the servicing or ports during the winter season, and will contribute to an increased freight turnover by water transport means.

FIGURE APPENDIX

Figure (p. 7) Diagram showing general layout of ship.
1-Trim sections; 2-Tiller compartment; 3-Diesel fuel tank; 4-stern electric motors; 5-Towing winch; 6-Main diesel generator; 7-Boiler room; 8-Auxilliary diesel generators; 9-Radio room; 10-Navigator's compartment (chart house); 11-Wheelhouse; 12-Captain's cabin; 13-Wardroom; 14-Bow electric propulsion motor; 15-Sickbay; 16-Two-man crew cabins; 17-Messroom; 18-Galley; 19-Exciter (driver) compartment; 20-Mechanical and electromechanical workshop.
A. Upper deck
B. Lower deck

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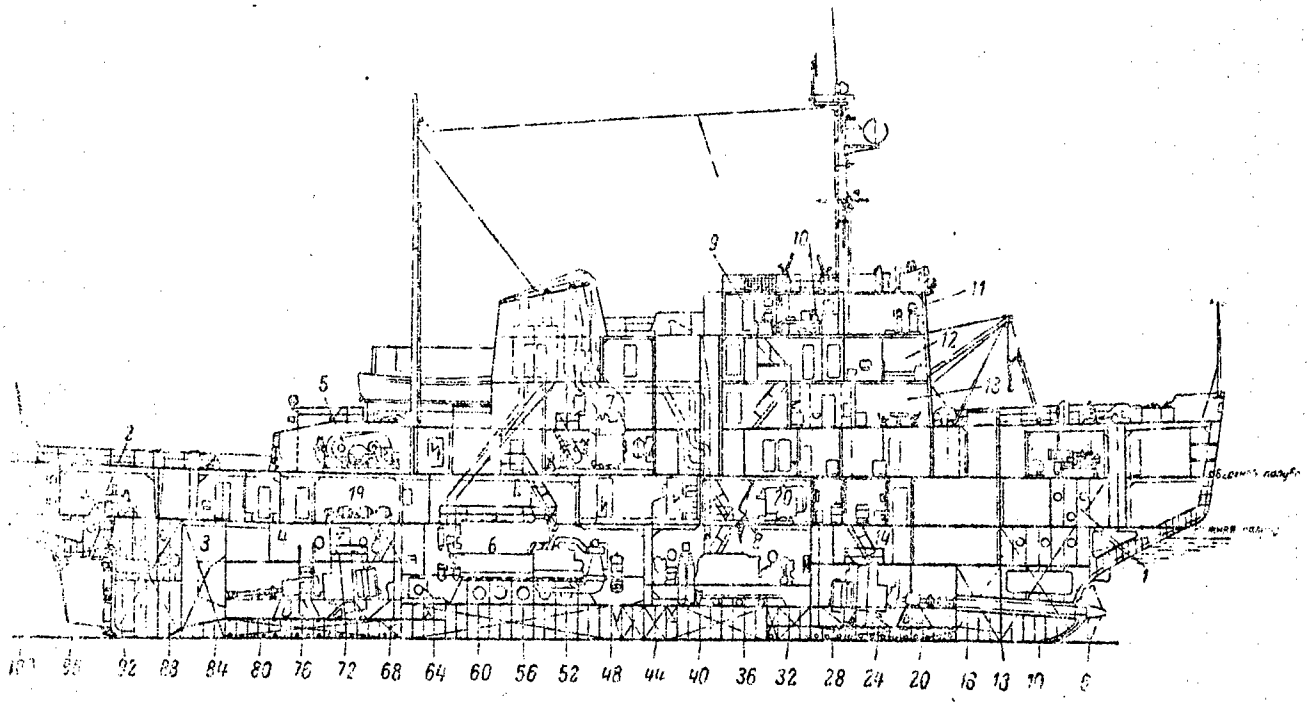
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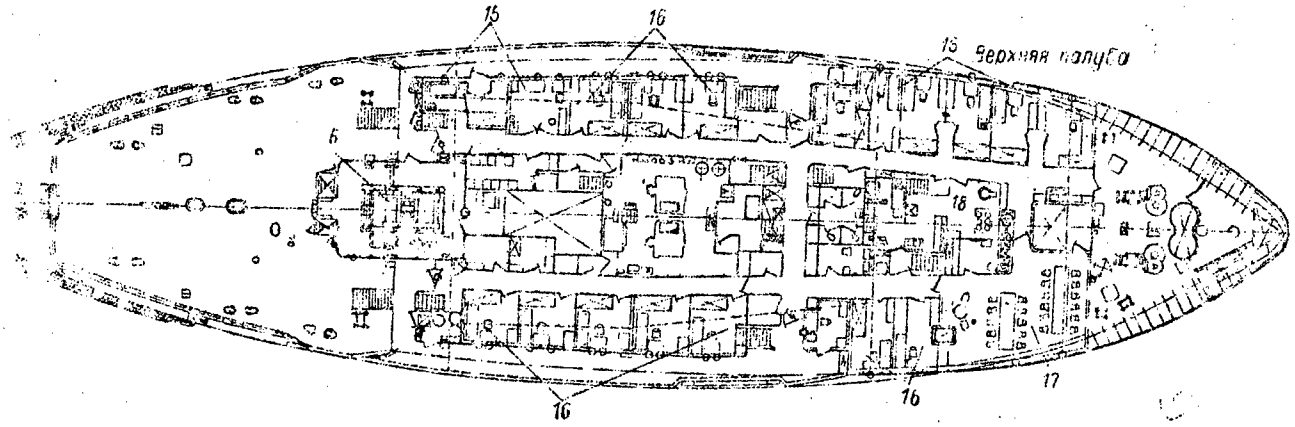
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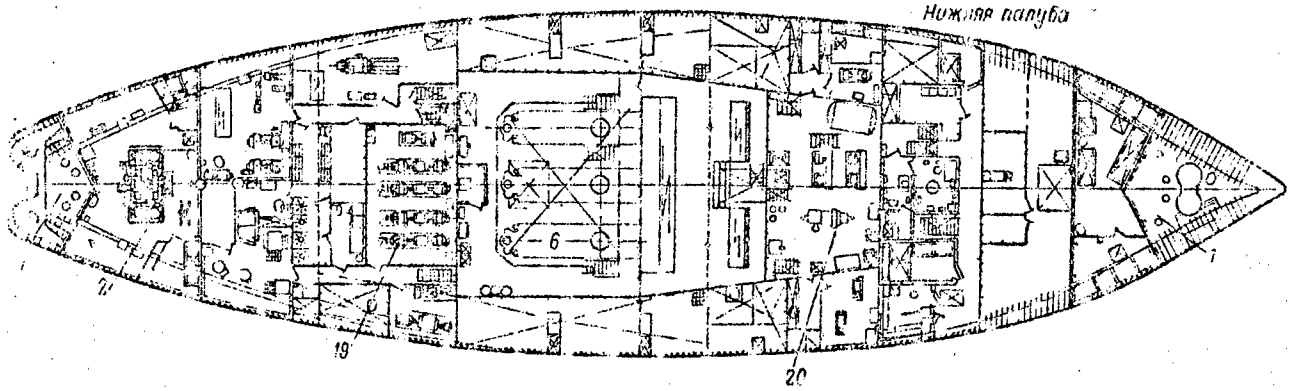
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